



INSTRUCTIONS FOR USE

PERISTALTIC PUMP UNIT

AFU-100

REF: WB950167 (100...240 V~)



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1 Important information

1.1 Intended use

The *AFU-100* is a peristaltic pump unit intended for irrigation of instruments or irrigation / flushing / cleansing of tissue surfaces and wounds supporting endoscopic diagnosis or therapy.

Contraindications:

The peristaltic pump unit must not be applied for intravenous fluid administration.

1.2 Instructions for use

These instructions for use contain essential information on using this peristaltic pump unit safely and effectively. Before use, thoroughly review these instructions for use and the instructions for use of all equipment which will be used during the procedure. Use the equipment as instructed. Keep this and all related instructions for use in a safe, accessible location. If you have any questions or comments about any information in these instructions for use, please contact Olympus or your distributor.

1.3 User qualification

The user must be a physician or medical personnel under supervision of a physician and must have received appropriate training in using this peristaltic pump unit. These instructions for use, therefore, do not explain or discuss medical procedures.

In addition, the user must undergo an instruction / training for the use of this unit. The instruction / training will be provided by authorised representatives of Olympus or your distributor during installation and commissioning.

Federal Law of the USA restricts this device to use by, or on the order of, a physician.

1.4 Peristaltic pump unit compatibility

Refer to chapter 10 (System chart) to confirm that this peristaltic pump unit is compatible with the ancillary equipment being used. Using incompatible equipment can result in patient injury and / or equipment damage.

1.5 Repair and modification

This peristaltic pump unit does not contain any user-serviceable parts. Do not disassemble, modify, or attempt to repair it; patient or user injury and / or equipment damage may result. Repairs must only be carried out by Olympus or a firm authorised by Olympus. Some problems that appear to be malfunctions may be corrected by referring to chapter 9 (Troubleshooting). If the problem cannot be resolved using the information in chapter 9, contact Olympus or your distributor.

1.6 Signal words

The following signal words are used throughout these instructions for use:

DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices or potential equipment damage.

NOTE Indicates additional helpful information.

1.7 Danger, warnings and cautions

Follow the dangers, warnings and cautions given below when handling this peristaltic pump unit. This information is to be supplemented by the dangers, warnings and cautions given in each chapter.

User-related error prevention

WARNING Improper use

The safety and effectiveness of medical procedures depends not only on the design of the equipment used, but also to a major extent on factors which are under the control of the user. It is therefore extremely important to read, understand and follow the instructions supplied with the peristaltic pump unit and the accessories in order to ensure safety and effectiveness.

Always use the peristaltic pump unit as outlined in these instructions for use. Improper use will not only impede functions and prevent optimum performance, but may cause equipment damage and / or complications. Before each use, always inspect the equipment as outlined in these instructions for use.

Environmental conditions

CAUTION Interference of the unit with other equipment

Be sure that this peristaltic pump unit is not used adjacent to or stacked with other equipment (other than the components of this peristaltic pump unit or system) to avoid electromagnetic interference.

Before use, thoroughly confirm the compatibility of all equipment.

To ensure electrical safety, the peristaltic pump unit should not be used in conjunction with equipment whose safety in combined use is not guaranteed.

The peristaltic pump unit complies with the electromagnetic compatibility (EMC) standard. Nevertheless, when the peristaltic pump unit is active it may disturb neighboring electronic equipment. Follow the instructions in chapter 12 (Electromagnetic compatibility) regarding electromagnetic ambient conditions.

Do not use the peristaltic pump unit in a location exposed to strong electromagnetic radiation (microwave or short-wave medical treatment equipment, Magnetic Resonance Imaging, radio or mobile phone equipment). Peristaltic pump unit malfunction can occur.

CAUTION Unsuitable temperature and humidity

The peristaltic pump unit should only be used under the conditions as described in chapter 11.2 (Technical data). Use under other conditions may impede normal performance and / or result in equipment damage.

Accessories

WARNING Mechanical stress

Do not apply excessive bending, straining, or squeezing force to any cords or tubes. It may cause malfunction.

CAUTION Non-compatible accessories and accessory damage

The peristaltic pump unit may only be used with compatible accessories.

Before use, the peristaltic pump unit and accessories must be examined for damage. All communication cables and its plugs must be free of scratches and cracks. Cables and accessories with damaged insulation or connections must not be used.

Electric shock

WARNING Grounding failure

To prevent the risk of electric shock, the housing of the peristaltic pump unit must be grounded. Always connect the power cord plug to a properly grounded wall outlet. Do not use a 3-pin / 2-pin adapter, as it can impair safe operation of the unit.

WARNING User shock

To prevent user shock, malfunction and damage of the peristaltic pump unit, keep liquids away from all electrical equipment. If liquid gets on or into the peristaltic pump unit, terminate operation immediately and contact Olympus or your distributor.

CAUTION Injury during servicing

When the housing is opened, there is a danger of electric shock. The unit must only be serviced by authorised technicians.

Fire / Explosion

DANGER Explosion

This peristaltic pump unit is not explosion-proof. Do not use the unit within an explosion zone.

WARNING Risk of fire

Disconnect the power plug before changing the fuses! Replace fuses as marked. The fuses must only be replaced by authorised technicians.

WARNING Ignitable cleaning- and disinfection agents

Flammable agents used for cleaning and disinfection must be allowed to evaporate before the peristaltic pump unit is used.

Non-flammable agents should be used for cleaning and disinfection wherever possible.

Procedural hazards and complications

DANGER Procedural hazards and complications

The safety of medical procedures will be greatly enhanced by a thorough knowledge of the medical literature on the subject. Study of specific information on the hazards and complications of the procedure in question is especially recommended.

WARNING Flow performance

If the peristaltic pump unit fails and the flow is stopped during treatment, it may be impossible to finish the treatment.

Should any abnormal flow be suspected during operation, immediately terminate the use of the peristaltic pump unit. If deactivation is not possible, switch off the peristaltic pump unit. Otherwise, malfunction of the equipment may cause an unintended increase in the flow.

CAUTION Unit defect

In the event of a defect or malfunction in the unit, an undesirably high flow output may occur.

2 General description

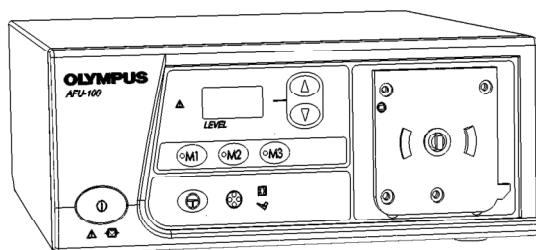
The *AFU-100* peristaltic pump unit is a roller pump. The rollers of the pump rotors squeeze the inserted pump tube so that the liquid in the pump tube is transported. This enables liquid media to be transported without coming into contact with the peristaltic pump unit. Sterile liquids (e.g. isotonic saline solution) thus remain sterile, provided that a sterile tube set is used.

The maximum flow rate is 270 ml and 600 ml per minute with two different tube sets (see chapter 11.1, Pump tube characteristics) offered as single use items. In addition, three memory buttons provide fast access to preset flow levels. The peristaltic pump unit can be connected to an electrosurgical unit by an interface, allowing operation of the peristaltic pump unit by a special button on the electrosurgical unit's footswitch.

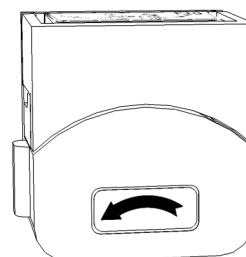
The pump rotor is equipped with a protective cover, which automatically stops the rollers from rotating if it is opened while the peristaltic pump unit is activated, and thus prevents possible injuries.

3 Inspection prior to use

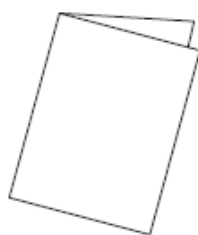
Verify that all items shown below are contained in the package. Inspect each item for damage. If the peristaltic pump unit is damaged, a component is missing or you have any questions, do not use the peristaltic pump unit. Contact Olympus or your distributor immediately.



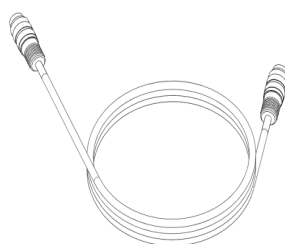
Peristaltic pump unit



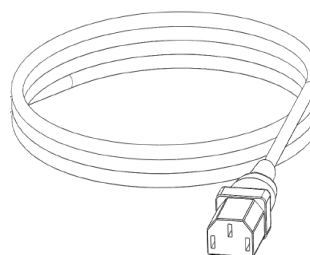
Pump head



Instructions for use



Communication cable



Power cord

The following items are optional and may be purchased separately from Olympus or your distributor:

- Footswitch
- Pump tube

4 Symbols, definitions and functions

4.1 Symbols and descriptions

4.1.1 Front panel



Power on / off



Caution



Defibrillation proof type CF applied part
(cardiac application)



Up (increase flow level)



Down (decrease flow level)



Flow on / off



Flow activation



Communication assignment with an
electrosurgical unit



Communication assignment with footswitch



Do not allow fingers to contact moving parts

M1

Memory 1

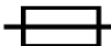
M2

Memory 2

M3

Memory 3

4.1.2 Rear panel

	Manufacturer
	Date of manufacture
	Serial number
	Reference number
	Indication of the direction of higher volume
	Loudspeaker
	Footswitch connection
	Interface for electrosurgical unit connection
	Operating instructions
	Waste electrical and electronic equipment
	Fuse
	Product carries the CE mark

4.1.3 Packaging



Keep away from rain



Fragile; handle with care



This way up



Temperature limit during transport and storage



Stacking limit by number (including lowest box)



Atmospheric pressure limitation during transport and storage



Relative humidity limitation during transport and storage



Quantity

4.1.4 Pump tube



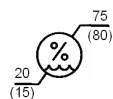
Disposable article – Do not reuse



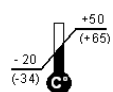
Do not resterilise



Sterilised with gamma radiation

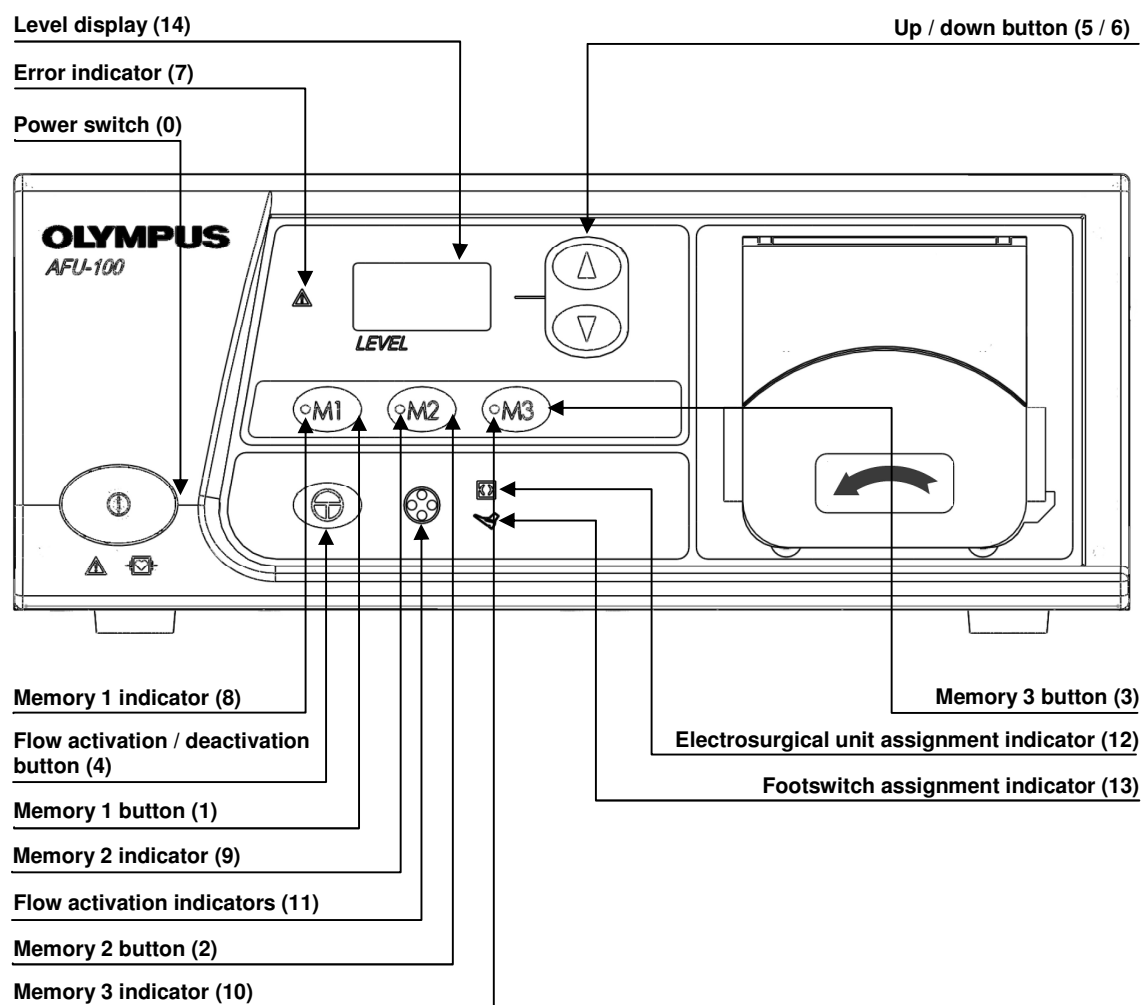


Relative humidity limitation for storage (during transport)



Temperature limit for storage (during transport)

4.2 Front panel



4.2.1 Buttons / Switches

- 0 Power switch**
This switch turns on and off the peristaltic pump unit.
- 1 / 2 / 3 Memory 1 / 2 / 3 button**
The memory buttons are used to store and recall previously stored flow levels. The *level display (14)* shows the selected flow level.
- 4 Flow activation / deactivation button**
This button is used to activate / deactivate the peristaltic pump unit with the selected flow level as shown in the *level display (14)*.
- 5 / 6 Up / down button**
These buttons increase / decrease the value displayed at the *level display (14)*.

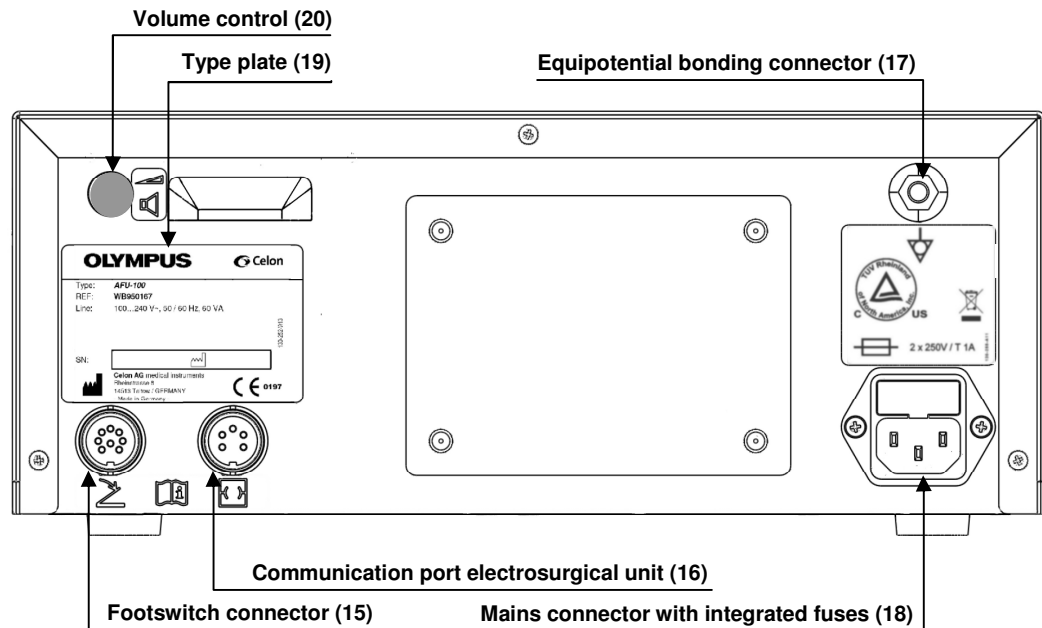
4.2.2 Indicators

- 7 Error indicator**
This indicator illuminates red if any error occurs.
- 8 / 9 / 10 Memory 1 / 2 / 3 indicator**
The corresponding indicator signals if one of the *memory buttons (1 / 2 / 3)* is pressed.
- 11 Flow activation indicators**
These indicators signal the activation of the peristaltic pump unit with the selected flow level as shown in the *level display (14)*.
- 12 Electrosurgical unit assignment indicator**
This indicator signals the communication assignment with an electrosurgical unit.
- 13 Footswitch assignment indicator**
This indicator signals the communication assignment with the peristaltic pump unit footswitch.

4.2.3 Displays

- 14 Level display**
This display shows the currently selected flow level.
- | | |
|------------------|--|
| 3 ... 100 | Flow level |
| E## | Error notice and related error number (##) |

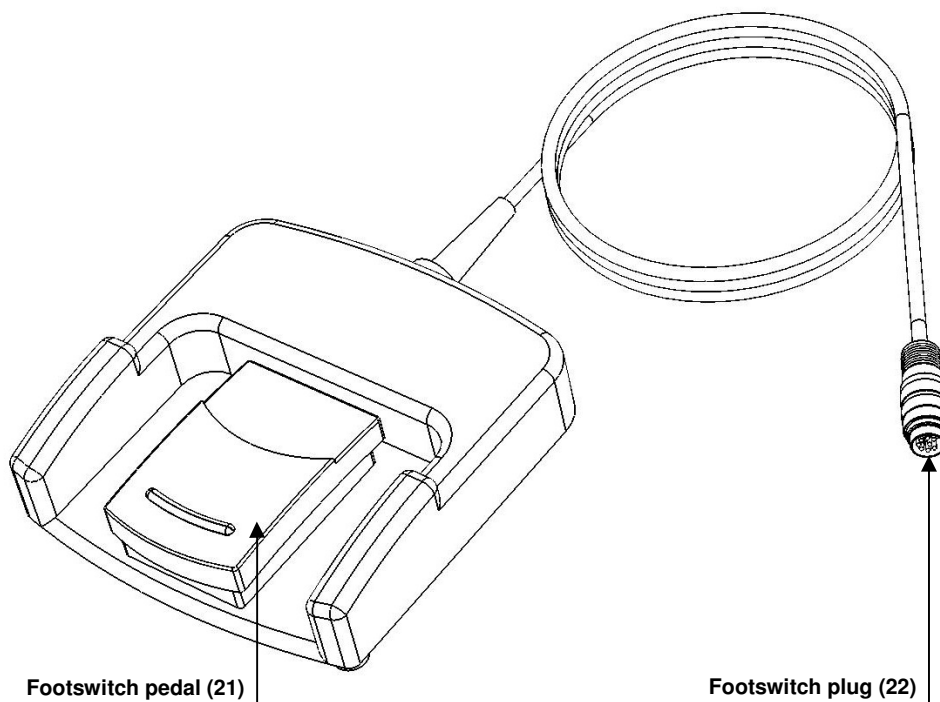
4.3 Rear panel



- 15 Footswitch connector**
This terminal connects the footswitch with the peristaltic pump unit, so that the flow can be activated / deactivated by the *footswitch pedal* (21).
- 16 Communication port for electrosurgical unit**
This terminal is used for the communication between the peristaltic pump unit and an electrosurgical unit.
- 17 Equipotential bonding connector**
This terminal is used for potential equalization.
- 18 Mains connector with integrated fuses**
This terminal serves as a connection to the mains power supply.
- 19 Type plate**
The type plate contains specific information about the peristaltic pump unit regarding type of device, reference number (REF), line voltage range, power consumption, serial number and the registered office of the manufacturer.
- 20 Volume control**
This knob is used for adjusting the volume.

5 Accessories

5.1 Footswitch



21 Footswitch pedal

This pedal is used to activate / deactivate the selected flow level.

22 Footswitch plug

Connects the footswitch with the peristaltic pump unit on the rear panel.

NOTE

The footswitch is an optional accessory. The selected flow level can also be activated / deactivated with the *flow activation / deactivation button (4)* as well as with a special button on the electrosurgical unit's footswitch.

5.2 Pump tube

The achievable flow rate depends on the diameter of the inserted pump tube, the used instrument (including its accessories) and the setting of the flow level (see chapter 11.1, Pump tube characteristics, chapter 7.3, Pump tube insertion and connection and chapter 7.4, Flow selection).

6 Installation and commissioning

The unit must be properly installed and commissioned by Olympus or your distributor or by a person or firm commissioned and authorised by the manufacturer.

Prepare the peristaltic pump unit and other equipment to be used with this peristaltic pump unit before each use. Refer to the instructions for use of the equipment, and install and connect all equipment as described on the following pages.

6.1 Installation of equipment

CAUTION

Install the unit on a stable, level surface. Otherwise, the unit could fall, causing equipment damage and / or injury to the user or patient.

If the peristaltic pump unit is placed on a cart, the cart must be of adequate strength and size to hold the unit securely.

Never place the peristaltic pump unit on its side or upside down. Otherwise, the peristaltic pump unit may not work correctly.

If the peristaltic pump unit is lifted up, do not hold the unit at the fuse holder at the rear panel to prevent damage of the unit.

NOTE

Place the instructions for use near the peristaltic pump unit or in another easily accessible place.

Before using an optional item, thoroughly review and understand the instructions for use provided with that item and check the compatibility with the peristaltic pump unit.

Specifications, design and accessories are subject to change without any notice or any obligation of the manufacturer.

6.2 Connection / disconnection of pump head

Connection of pump head

- 1) Engage the pump head drive slot with the end of the pump drive shaft (approximately 45° position, see fig. 6.1). Continue to align the pump head until the bayonet engages with the mounting plate. Ensure that the arrow on the front of the pump head is pointing to the left side.
- 2) Turn the pump head clockwise until it locks into an upright and secure position.

Disconnection of pump head

- 1) Push the locking lever (see fig. 6.1) back and turn the pump head counterclockwise until it is free from the mounting plate.
- 2) Remove the pump head.

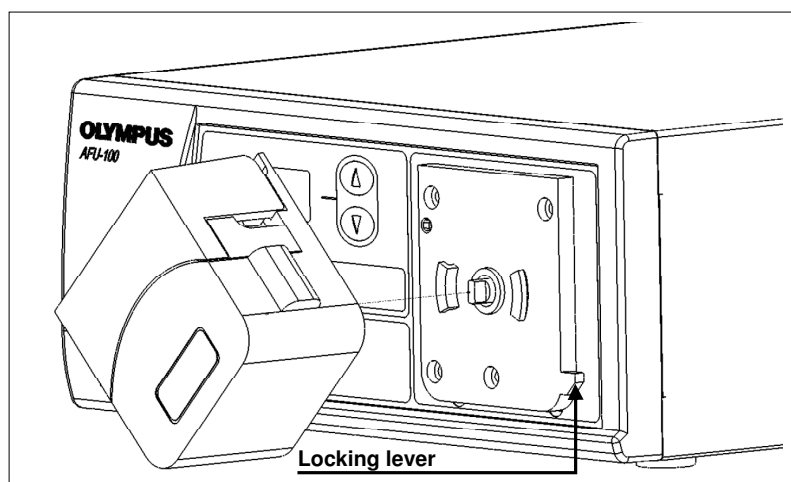


Fig. 6.1: Connection / disconnection of pump head

6.3 Connection to an AC mains power supply

- 1) Confirm that the power of the peristaltic pump unit is off.
- 2) Connect the power cord to the *mains connector (18)* of the peristaltic pump unit (see fig. 6.2).
- 3) Connect the power plug of the power cord directly to a grounded wall outlet which meets the power requirements indicated on the electrical rating plate on the rear panel of the peristaltic pump unit.

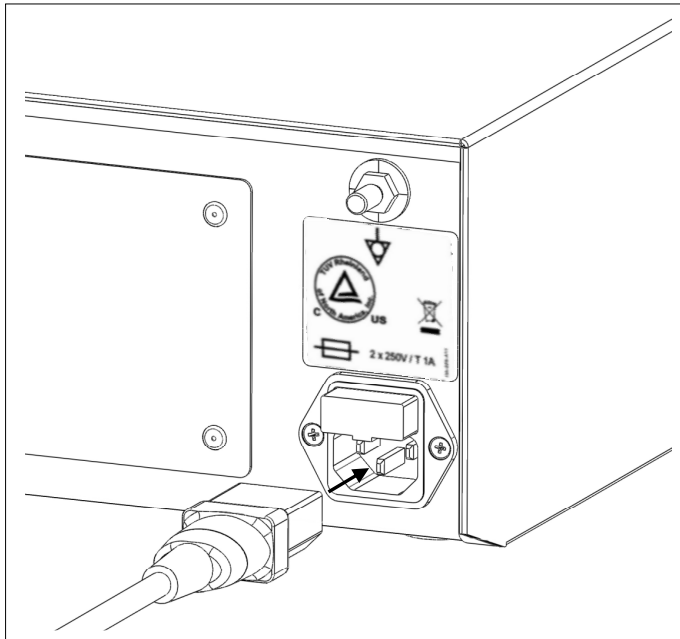


Fig. 6.2: Connection of the power cord

DANGER

Connect the power plug of the power cord directly to a grounded wall outlet or to a multiple power socket outlet equipped with an insulating transformer of protection class I, conforming to IEC 60601-1. The multiple power socket outlet shall conform with the requirements of the IEC 60601-1-1 standard. In this case, observe the maximum permitted current or power loading of the multiple power socket outlet and the insulating transformer.

CAUTION

Always use the power cord provided with the peristaltic pump unit or a cable of similar quality (see chapter 11.2, Technical data). Never attempt to modify the power cord.

Firmly plug in the power cord so it will not accidentally be dislodged during the operation.

If the same circuit breaker is used to supply power to other electrical equipment, carefully consider the power requirements of the additional equipment and use circuit breakers that have ample capacity. Otherwise, the peristaltic pump unit does not work correctly.

Portable multiple power socket outlets must not be placed on the floor. Do not use an additional extension cable or other multiple power socket outlets that are not expressly approved by the manufacturer for joint use.

NOTE

Before connecting to the power supply, check that the supply voltage agrees with the electrical data on the type plate of the peristaltic pump unit.

If the voltage of the facility is different from the voltage indicated on the type plate of the peristaltic pump unit, contact Olympus or your distributor.

6.4 Equipotential bonding

To increase electrical safety, the unit can be connected to the equipotential bonding system of the treatment room. All equipment housings that come into contact with the patient are electrically connected in order to prevent low-frequency electrical currents from endangering the patient in the event of a defect in the conventional protective conductor system.

6.5 Connection of footswitch

Before connecting, confirm that the *footswitch plug* (22) is free of scratches and cracks and that the *footswitch pedal* (21) is not damaged. Align the *footswitch plug* (22) so that the keying is facing down. Insert the *footswitch plug* (22) into the *footswitch connector* (15) of the peristaltic pump unit on the rear panel and rotate the fastener ring fully clockwise to tighten it (see fig. 6.3).

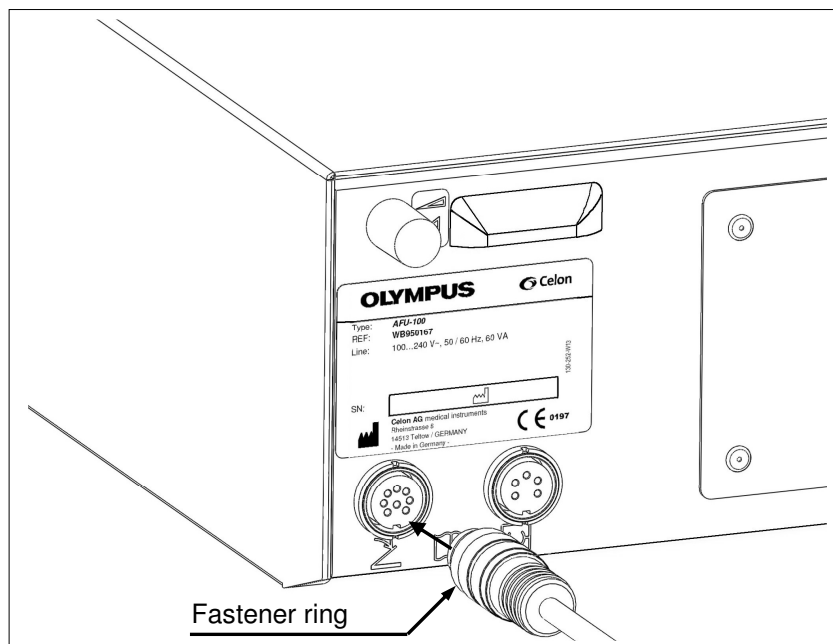


Fig. 6.3: Connection of the footswitch

CAUTION

The footswitch plug is not waterproof, and liquid such as water must not get into the plug.

Do not connect products other than the footswitch for this peristaltic pump unit to the *footswitch connector* (15). Otherwise, the footswitch might not function and may cause patient injury and / or damage of the equipment.

NOTE

If the peristaltic pump unit is connected via the communication cable with an electrosurgical unit and communication is established, the footswitch of the peristaltic pump unit cannot be used. In this case, the peristaltic pump unit will be controlled by the electrosurgical unit's footswitch.

6.6 Connection to an electrosurgical unit

The peristaltic pump unit together with an electrosurgical unit can build a system as shown in fig. 6.4. If the communication to an electrosurgical unit is established and both units are switched on, a special button on the electrosurgical unit's footswitch activates the pump flow.

Align the plugs of the communication cable that the keying is facing down and insert the plugs into the *communication ports* of the electrosurgical unit and the peristaltic pump unit and rotate the fastener rings fully clockwise to tighten it (see fig. 6.4).

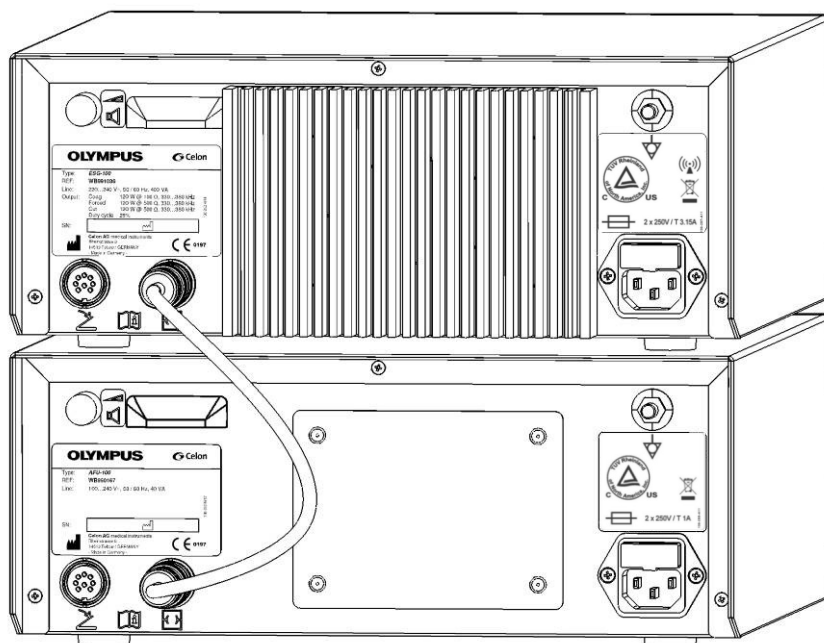


Fig. 6.4: Connection of an electrosurgical unit (e.g. *ESG-100*) and the peristaltic pump unit

NOTE

It is recommended to position the electrosurgical unit on top of the peristaltic pump unit to avoid spilling of liquids over the electrosurgical unit.

7 Operation

Prepare this peristaltic pump unit and other equipment to be used with this unit for the particular operation. Refer to the respective instructions for use for each item. Confirm that the connections of the power cord, footswitch, pump tube and instruments are secure and correct.

WARNING

Before each use, inspect this unit as instructed below. Inspect other equipment to be used with this unit as instructed in their respective instructions for use. Should the slightest irregularity be suspected, do not use the peristaltic pump unit and refer to chapter 9 (Troubleshooting). If the irregularity is still suspected after consulting chapter 9, contact Olympus or your distributor. Damage or irregularity may compromise patient or user safety and may result in more severe equipment damage.

7.1 Power supply

Switch on the peristaltic pump unit with the *power switch (0)*. The unit executes a self test. All indicators of the unit illuminate sequentially during the self test and the three numbers of the *level display (14)* count from 0 to 9. At the end of the self test, all indicators of the unit illuminate simultaneously and an alarm tone can be heard. The unit is prepared for use and recalls the last flow level used.

By using the peristaltic pump unit for **the first time** there will be a default setting of the flow level and the *memory buttons (1 / 2 / 3)*.

By switching on the peristaltic pump unit **after one or more procedures** have been done, the last used flow level is presented at the *level display (14)*. Before starting the procedure, confirm the correctness of the settings.

CAUTION

If the peristaltic pump unit fails to start up (no indicators illuminate and the *level display (14)* is off), confirm that the power cord is connected securely to a grounded wall outlet and the *mains connector (18)* on the peristaltic pump unit and confirm that the grounded wall outlet is powered. If it still fails to start up, remove the power cord from the grounded wall outlet and contact Olympus or your distributor. Equipment damage or malfunction may have occurred and fire or electric shock can result.

NOTE

To enable the immediate continuation of the procedure in case of a power failure (less than 15 seconds) or unintended switching off and on (within 15 seconds), no self test will be performed. The peristaltic pump unit recalls the last settings used.

The self test cannot be interrupted before it is finished.

7.2 Acoustic signals and tone volume adjustments

Confirmation and warnings

The confirmation and warning tones volume can be adjusted on the rear panel by using the *volume control (20)*. The confirmation tone can be either associated with one short “beep” or with one long “beep”. A short “beep” tone occurs, if a button on the front panel is pressed. A long “beep” tone occurs, if a flow level has been stored using one of the *memory buttons (1 / 2 / 3)*.

The warning tone is associated with a short, interrupted “beep”. It occurs, if the adjustment limits (e.g. minimum or maximum flow level) has been reached.

Alarms

The alarm tone is associated with an error message shown on the *level display (14)* and has a louder tone with a higher frequency than the warning “beep” tone.

NOTE

The volume of the alarm tone is not adjustable.

7.3 Pump tube insertion and connection

The tubing sets are supplied in individual, sterile packaging. Check the sterile tubing packaging for damage and remove the tubing from the packaging.

- 1) Lift the protective cover of the pump head.
- 2) Slide the pump tube into the open pump head as shown in fig. 7.1 and fig. 7.2. The pump tube must not be twisted or stretched against the rollers.
- 3) Ensure the pump tube is located in the centre of the tube clamps and carefully close the protective cover. Confirm that the pump tube is not crushed in the clamps or over stretched.
- 4) Attach the 'male' connector of the fluid reservoir tube with the 'female' connector of the pump tube (right side). Attach the 'female' connector of the instrument tube with the 'male' connector of the pump tube (left side).

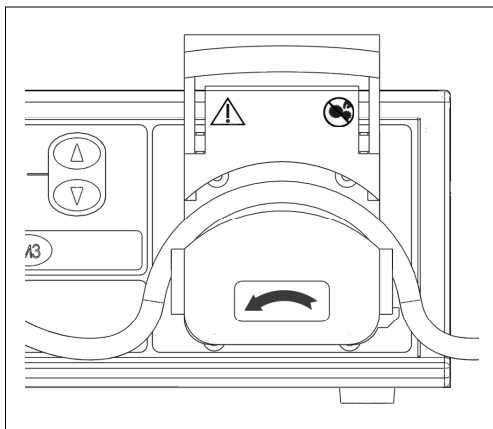


Fig. 7.1: Protective cover in opened position with inserted pump tube (front view)

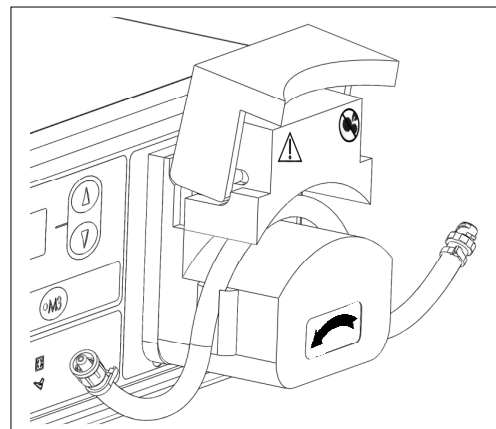


Fig. 7.2: Protective cover in opened position with inserted pump tube (side view)

WARNING

Always use compatible and sterile pump tubes (see chapter 11.2, Technical data) as well as sterile liquids (e.g. isotonic saline solution). Do not use damaged pump tubes.

CAUTION

Before use, inspect the sterile pump tube package for tears, inadequate sealing, or water damage. Do not use pump tubes from damaged sterile packaging.

Do not use pump tubes after the expiration date displayed on the sterile package.

The pump tube is a single-use product and must be disposed off after being used once. Do not reuse or attempt to sterilize it.

Turn off the flow activation before inserting or removing the pump tube.

7.4 Flow selection

Select a flow level in accordance with the type of procedure and instruments to be used. Refer to fig. 11.1, chapter 11.1 (Pump tube characteristics) for the flow rate of different pump tubes.

For changing the flow level by e.g. 3 (from flow level 3 to 6), press the *up / down button (5 / 6)* for 3 times. For a significant change of the flow level continuously press the *up / down button (5 / 6)*. Refer to table 7.1 for the stepping range.

If the unit will be used for the first time, the flow level starts with 3. The default flow level of the *memory button (1)* is 3, *memory button (2)* is 30 and *memory button (3)* is 100.

Flow level	Digit stepping
3 ... 20	1
> 20 ... 50	2
> 50 ... 100	10

Table 7.1: Stepping range of the flow level

WARNING

Use the lowest appropriate flow level to achieve the desired effect. Inappropriate flow can cause perforation. It is recommended to do appropriate examination before using on a human body.

NOTE

The flow level is indicated on the *level display (14)* as a relative flow rate. The effective flow rate (milliliter / minute) depends on the pump tube specification (e.g. inner tube diameter). Refer to fig. 11.1, chapter 11.1 (Pump tube characteristics) for a detailed overview of the flow level, corresponding flow rate and the used pump tube.

If the minimum / maximum flow level is reached, a warning tone can be heard.

The flow level can be changed while the flow is activated.

This peristaltic pump unit stores the last set flow level automatically. By switching on the power, the last flow level will be recalled.

7.5 Store and recall flow levels

Three memory buttons are available to store e.g. frequently used flow levels. To store a set flow level, press one of the preferred *memory buttons (1 / 2 / 3)* for approximately one second until a long confirmation tone can be heard. To use a stored flow level, press the corresponding *memory buttons (1 / 2 / 3)* shortly and the equivalent *memory indicator (8 / 9 / 10)* illuminates. The stored flow level appears on the *level display (14)*.

NOTE

The *memory buttons (1 / 2 / 3)* are disabled if the flow is activated.

7.6 Activation / deactivation of the flow

Activate the set flow level by pressing the *flow activation / deactivation button (4)* or, if connected, the *footswitch pedal (21)* or with a special button on the electrosurgical unit's footswitch.

The output is activated as long as the footswitch is pressed. During the activated flow, the *flow activation indicators (11)* illuminates sequentially. The flow will be stopped when the *flow activation / deactivation button (4)* is pressed again or, if connected, the *footswitch pedal (21)* or a special button on the electrosurgical unit's footswitch will be released.

DANGER

If inadequate flow is observed or the flow does not stop, end the procedure immediately. Use the *power switch (0)* as emergency stop for malfunctions (e.g. in case the *flow activation / deactivation button (4)* or the footswitch does not react).

The peristaltic pump unit has no suction function! Keep a suction pump available in case excessive liquid must be removed.

If a flow level is set below 20, the peristaltic pump unit does **not** stop automatically. Unintended amounts of liquid can accumulate within the patient's body.

WARNING

Wear personal protective equipment to guard against dangerous chemicals and potentially infectious material. During operation, wear appropriate personal protective equipment, such as eye wear, face mask, moisture-resistant clothing and chemical-resistant waterproof gloves that fit properly and are long enough so that your skin is not exposed.

Check the flow level before each application. The physician has the responsibility to verify the effect of the flow level setting.

Never use toxic, acid or non-sterile liquids. Otherwise, it may cause user and / or patient toxications, chemical burns or infections.

If there is a malfunction at the *flow activation / deactivation button (4)* or the *footswitch pedal (21)* or the electrosurgical unit's footswitch, continuous flow may cause patient injury.

NOTE

If the peristaltic pump unit is connected with the footswitch via the *footswitch plug (22)*, the *footswitch assignment indicator (13)* illuminates and activation / deactivation is possible with the *footswitch pedal (21)*. If the peristaltic pump unit is connected with an electrosurgical unit, the *electrosurgical unit indicator (12)* illuminates and activation / deactivation is possible with a special button on the electrosurgical unit's footswitch. The *flow activation / deactivation button (4)* can always be used to activate or deactivate the flow.

To avoid patient injury, the maximum activation time is limited to 20 seconds, if a flow level higher than 20 has been set. After exceeding the time limit, the unit will be deactivated automatically. To continue the procedure, the flow has to be activated again.

7.7 Procedure after use

- 1) Switch off the peristaltic pump unit.
- 2) Remove the pump tube.
- 3) If the peristaltic pump unit is not used for a long time period, disconnect the power cord plug from the grounded wall outlet.
- 4) Clean the components following the instructions in chapter 8 (Cleaning, storage and disposal).

CAUTION

When disconnecting plugs of accessories or power cords, always hold the plug. Pulling the cable may result in damaging of the wires.

8 Cleaning, storage and disposal

After each use, perform the following cleaning procedures immediately. If cleaning is delayed, debris encrustation may become a source of infection. Encrustation may also result in malfunction of the peristaltic pump unit. For maintenance and storage of other items than those described below, refer to the respective instructions for use.

8.1 Cleaning

All surfaces of the unit's housing can be cleaned and disinfected with the cleaning agents and surface disinfectants normally used for medical equipment (mild cleaning solution, e.g. 70 % isopropyl alcohol). No liquid must enter the connector or the unit during cleaning.

- 1) Switch off the peristaltic pump unit and disconnect the power cord from the grounded wall outlet. If necessary remove the pump head as described in chapter 6.2 (Connection / disconnection of pump head).
- 2) If the equipment and / or accessories are contaminated with blood or other potentially infectious materials, first wipe off all gross debris using neutral detergent, and then wipe its surface with a lint-free cloth moistened with a surface disinfectant.
- 3) To remove dust, dirt and non-patient debris, wipe the peristaltic pump unit and footswitch using a soft, lint-free cloth moistened with 70 % ethyl or isopropyl alcohol.

WARNING

After cleaning the peristaltic pump unit, dry it thoroughly before storage or using it again. If it is used while still wet, there is a risk of electric shock.

Patient debris and reprocessing chemicals are hazardous. During cleaning and disinfection, always wear appropriate personal protective equipment, such as eye wear, face mask, moisture-resistant clothing and chemical-resistant waterproof gloves that fit properly so that your skin is not exposed. Always remove contaminated protective clothing before leaving the reprocessing area.

CAUTION

Never immerse the peristaltic pump unit in water, clean or disinfect by immersion, gas sterilization or autoclaving. It may cause equipment damage.

Do not clean the connectors or the alternating current power inlet. Cleaning them can deform or corrode the contacts, which could damage the peristaltic pump unit.

Do not wipe the external surface with hard or abrasive wiping material. The surface will be scratched.

8.2 Storage

Before storage of the peristaltic pump unit, disconnect the power cord. Store the unit and the pump tube packages properly according to the environmental conditions described in chapter 11.2 (Technical data).

CAUTION

Do not store the peristaltic pump unit and the pump tube packages in a location exposed to direct sunlight, x-rays, radioactivity, liquids or strong electromagnetic radiation (e.g. near microwave medical treatment equipment, short-wave medical treatment equipment, magnetic resonance imaging equipment, radio or mobile phones). Damage to the peristaltic pump unit or the pump tube package may result.

Store the pump tube packages so that there is no risk of damage to the packaging or the sterile contents.

The pump tube sterile packaging must be handled with care.

8.3 Disposal of the unit

When disposing of this peristaltic pump unit, or any of its components (such as fuses), follow all applicable national and local laws and guidelines.

Waste electrical and electronic equipment

In accordance with European Directive 2002/96/EC on waste electrical and electronic equipment (WEEE), the product must not be disposed of as unsorted municipal waste, but should be collected separately.

Refer to Olympus or your distributor for return and / or collection systems available in your country.

9 Troubleshooting

If the peristaltic pump unit has visible damage, do not use the unit and contact Olympus or your distributor. If the unit is not functioning properly, use the information in this chapter to identify and correct the malfunction. If the problem cannot be resolved by the described remedial action, stop using the peristaltic pump unit and contact Olympus or your distributor for repair.

DANGER

Never use the peristaltic pump unit if an abnormality is suspected. The patient can be seriously injured.

CAUTION

Repairs must only be carried out by Olympus or a firm authorised by Olympus.

9.1 Error codes and measures

Follow the troubleshooting advices in this chapter, to identify or correct failures.

Level display	Related function	Description
E01, E02, E03, E06	Self test	Please contact the technical service.
E10, E11, E12, E13, E16, E20	Standby	Please contact the technical service.
E15	Standby	The protective cover of the pump head is opened / the pump head is not connected properly / is in a straight down position / an incompatible pump head is used when trying to activate the unit. Close the protective cover / connect the pump head properly / correct the pump head to an upright position / use a compatible pump head and activation is possible. If the error occurs again, please contact the technical service.
E21, E22, E23, E26, E27, E30	Activation	Please contact the technical service.
E24	Activation	The motor of the rollers is blocked. Remove the blockage. If the error occurs again, please contact the technical service.
E25	Activation	The protective cover of the pump head is opened / the pump head is not connected properly. Close the protective cover / connect the pump head properly and activate again. If the error occurs again, please contact the technical service.
E28	Activation	The communication assignment between the peristaltic pump unit and an electrosurgical unit failed or has been disconnected. Check the connection / the cable / confirm that the electrosurgical unit has not been switched off. If the error occurs again, please contact the technical service.
E90, E91, E92, E93, E94, E95, E96, E97	Self test, standby or activation	Please contact the technical service.
E##	Any related function	If any error occurs permanently or repetitively, please contact the technical service.

9.2 Periodic safety checks

The peristaltic pump unit and the footswitch must undergo a safety check in yearly intervals in accordance with the national statutory regulations. For this purpose, Olympus or a firm authorised by Olympus must be commissioned by the user.

9.3 Returning the peristaltic pump unit for repair

Before returning the peristaltic pump unit for repair, contact Olympus or your distributor. With the peristaltic pump unit, include a description of the malfunction or damage and the name and the telephone number of a contact person.

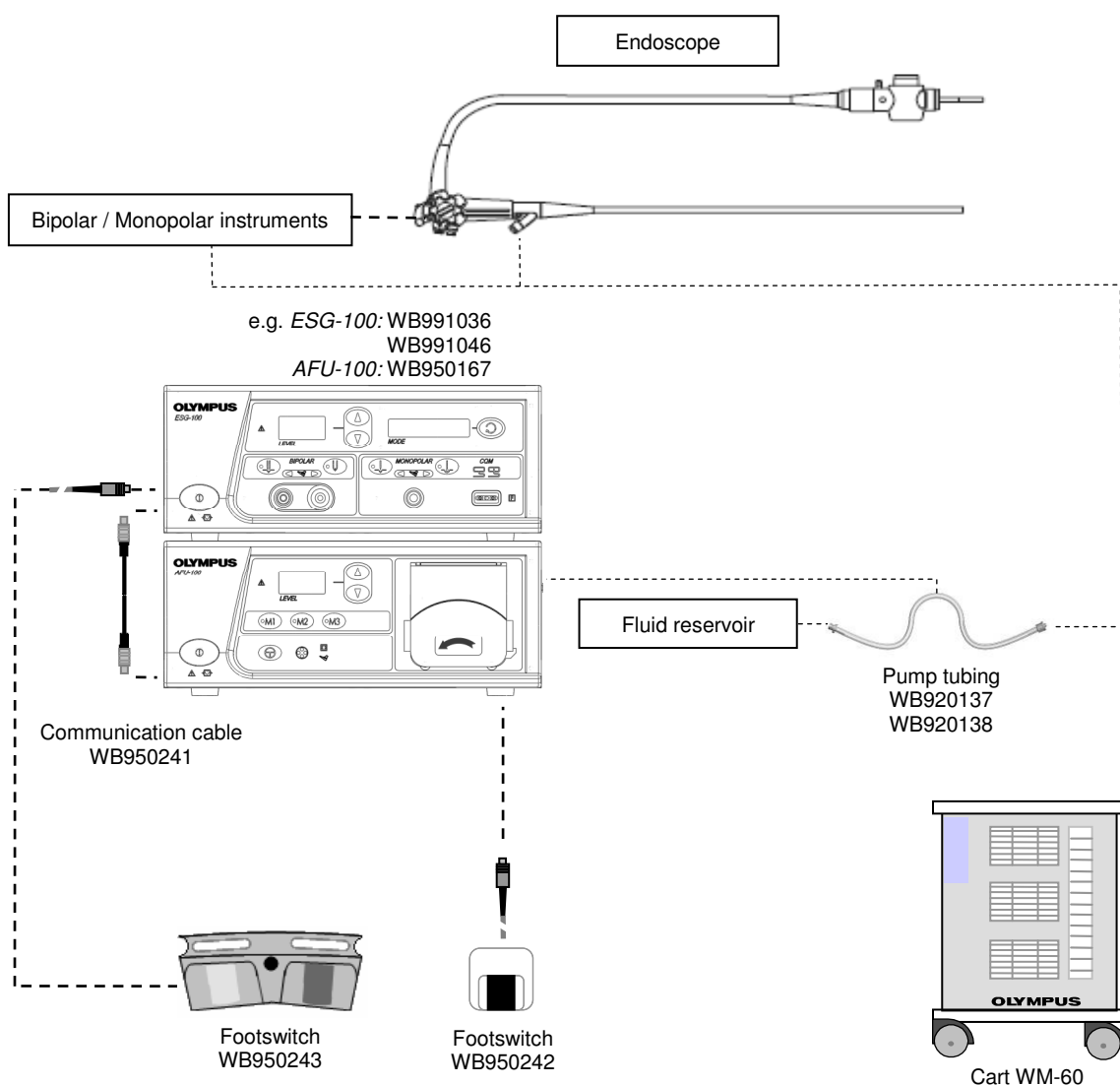
Repairs must only be carried out by Olympus or a firm authorised by Olympus. Service documents such as circuit diagrams, parts lists, equipment descriptions and setting instructions are available from Olympus for technicians who are authorised to carry out maintenance and repair.

10 System chart

The recommended combinations of equipment and accessories that can be used with this peristaltic pump unit are shown below. New products released after the introduction of this peristaltic pump unit may also be compatible for use in combination with this peristaltic pump unit. For further details, contact Olympus or your distributor.

WARNING

If combinations of equipment other than those shown below are used, the full responsibility is assumed by the medical treatment facility.



11 Specifications

11.1 Pump tube characteristics

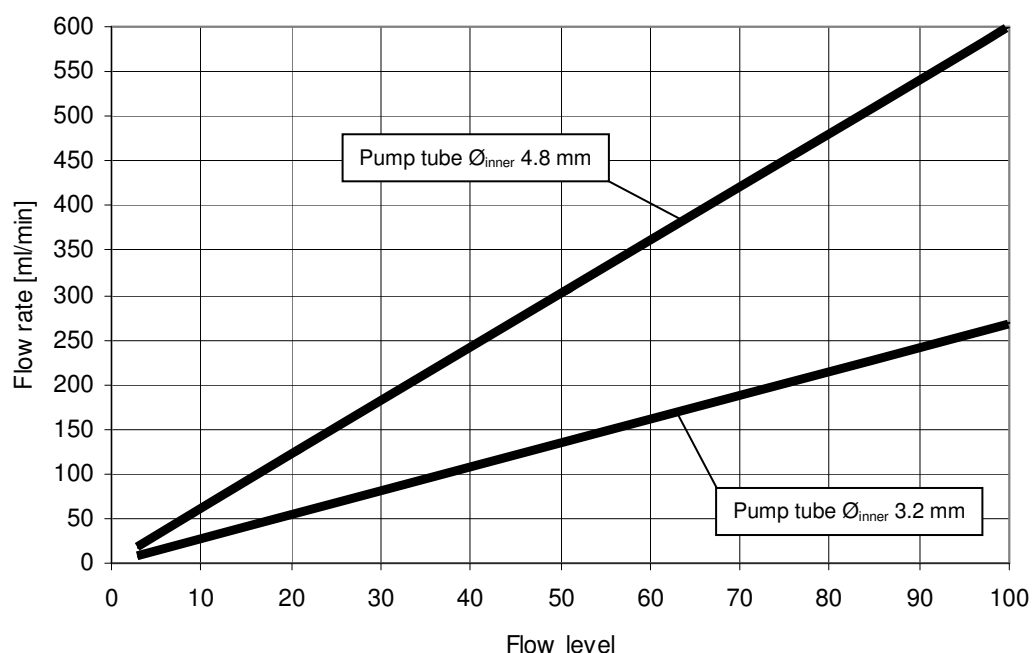


Fig. 11.1: Flow level and the corresponding flow rates for pump tubes with inner diameter of 4.8 mm and 3.2 mm

CAUTION

The achievable flow rate also depends on the used instrument and its accessories.

11.2 Technical data

Unit designation / description	<i>AFU-100</i> peristaltic pump unit REF: WB950167 (100...240 V~)
Compatible electrosurgical units	<i>ESG-100</i> REF: WB991036 (220...240 V~) REF: WB991046 (100...120 V~)
Output	
Flow level	3...100
Memory functions	3
Maximum delivery pressure	approximately 3.5×10^5 Pa (3.5 bar)
Pump head	
Rollers	4

General data

Protection class according to IEC 60601-1	CF, Class I
Classification according to MDD 93/42/EEC	IIb
Voltage range	100...240 V~
Frequency	50 / 60 Hz
Maximum input power	60 VA
Terminal for potential equalization	Yes
Power fuse	1 A (only FST series from Schurter or 219 series from Littelfuse or S506 series from Bussmann)
Power connection line	IEC 60320-1 / C13

Size

Width x Depth x Height	295 x 430 x 115 mm
Weight	5.6 kg
Volume	14588 cm ³

Footswitch (optional, REF: WB950242)

Width x Depth x Height	175 x 240 x 50 mm
Weight	1.6 kg

Environmental conditions
Normal operation

Temperature	+ 10...+ 40 °C
Relative humidity	10...85 %, non-condensing
Atmospheric pressure	50...106 kPa

Transport and storage

Temperature	- 34...+ 65 °C
Relative humidity	10...85 %, non-condensing
Atmospheric pressure	50...106 kPa

Accessories

Compatible pump tubes

 $\varnothing_{\text{outer}}$ 8.0 mm, $\varnothing_{\text{inner}}$ 4.8 mm

REF: WB920138

 $\varnothing_{\text{outer}}$ 6.4 mm, $\varnothing_{\text{inner}}$ 3.2 mmREF: WB920137

Environmental conditions (pump tube)

Normal operation

Temperature + 10...+ 40 °C

Relative humidity 15...80 %, non-condensing

Transport

Temperature - 34...+ 65 °C

Relative humidity 15...80 %, non-condensing

Storage

Temperature - 20...+ 50 °C

Relative humidity 20...75 %, non-condensing

12 Electromagnetic compatibility (EMC)

12.1 Guidance and manufacturer's declaration – electromagnetic emissions

The peristaltic pump unit is intended for use in the environment specified bellow. The user of the peristaltic pump unit should assure that it is used in such an environment.

Emission test	Compliance	Electromagnetic environment – guidance
High frequency emissions CISPR 11	Group 1	The peristaltic pump unit uses high frequency signals only for its internal function. Therefore, its high frequency emissions are very low and are not likely to cause any interference in nearby electronic equipment.
High frequency emissions CISPR 11	Class B	The peristaltic pump unit is suitable for the use in all establishments, including domestic establishments and those directly connected to the public-low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3	complies	

Length of power connection line: ≤ 3 m

CAUTION

The peristaltic pump unit should not be used adjacent to or stacked with other electrical equipment, except devices which are intended for this purpose and tested by the manufacturer.

The use of accessories which are not approved by the manufacturer may result in an increase of electromagnetic emissions and the compliance with the stipulated limit values are not guaranteed anymore.

12.2 Guidance and manufacturer's declaration – electromagnetic immunity

The peristaltic pump unit is intended for use in the environment specified below. The user of the peristaltic pump unit should assure its use in such an environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) according to IEC 61000-4-2	± 6 kV contact discharge ± 8 kV air discharge	± 6 kV contact discharge ± 8 kV air discharge	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic materials, the relative humidity should be at least 30 %.
Electrical fast transient / burst according to IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV ± 1 kV	The quality of the power supply voltage should comply with a typical commercial or hospital environment.
Surges according to IEC 61000-4-5	± 1 kV for differential mode ± 2 kV for common mode	± 1 kV ± 2 kV	The quality of the power supply voltage should comply with a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations of power supply input lines according to IEC 61000-4-11	< 5 % for 5 s < 5 % for 0.5 periods 40 % for 5 periods 70 % for 25 periods	< 5 % for 5 s < 5 % for 10 ms 40 % for 100 ms 70 % for 500 ms	The quality of the power supply voltage should comply with a typical commercial or hospital environment. If the user of the peristaltic pump unit requires continuous operation during power supply interruption, it is recommended that the peristaltic pump unit should be powered from an uninterruptible power supply or a battery.
Magnetic fields of mains frequency (50 / 60 Hz) according to IEC 61000-4-8	3 A/m	3 A/m	Magnetic fields of mains frequency should comply with typical levels characteristic of commercial or hospital environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment – guidance
			Portable and mobile high frequency communication equipment should be used not closer to any part of the peristaltic pump unit, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter; where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m):
Conducted high frequency according to IEC 61000-4-6	3 V _{eff} 150 kHz to 80 MHz	3 V	1.2 * Square root (P)
Radiated high frequency according to IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	1.2 * Square root (P) for 80 ... 800 MHz 2.3 * Square root (P) for 800 MHz ... 2.5 GHz The field strength from fixed high frequency transmitters, as determined by survey, should be less than the compliance level.

Interference may occur in the vicinity of equipment marked with the symbol “non-ionising radiation”.


NOTE

This guideline may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

The field strength from fixed transmitters, such as base stations from radio (cellular / cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be theoretical predicted with exact accuracy.

To assess the electromagnetic environment due to fixed high frequency transmitters, a site survey should be considered. If the measured field strength at the location, where the peristaltic pump unit is used, exceeds the above applicable compliance level, the peristaltic pump unit should be observed to verify normal operation.

If unusual performance characteristics are observed, additional procedures may be necessary, such as reorientation or relocating of the peristaltic pump unit.

Over the frequency range 150 kHz to 80 MHz, the field strength should be less than 3 V/m.

12.3 Recommended separation distances between portable and mobile high frequency communication equipment and the peristaltic pump unit

The peristaltic pump unit is intended for use in an electromagnetic environment where the radiated high frequency disturbances are controlled. The user of the peristaltic pump unit can help to prevent electromagnetic interference by maintaining a minimal distance between portable and mobile high frequency communication equipment (transmitters) and the peristaltic pump unit, according to the maximum output power of the communication equipment, as recommended below.

Rated output power of the transmitter P in W	Separation distance d according to frequency of the transmitter in meter (m)		
	150 KHz ... 80 MHz	80 ... 800 MHz	800 MHz ... 2.5 GHz
general	$1.2 \cdot \text{Square root (P)}$	$1.2 \cdot \text{Square root (P)}$	$2.3 \cdot \text{Square root (P)}$
0.01	0.1 m	0.1 m	0.2 m
0.1	0.4 m	0.4 m	0.7 m
1	1.2 m	1.2 m	2.3 m
10	3.7 m	3.7 m	7.4 m
100	11.7 m	11.7 m	23.3 m

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE

This guideline may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

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